REMARKS

The Office Action mailed July 28, 2004, has been carefully reviewed and, by this Amendment, Applicants have amended claim 11. Claims 1-12 are pending, and claim 12 has been withdrawn.

In response to the Examiner's requirement that the Applicants restrict the application to either the device or method claims, Applicants confirm the provisional election made without traverse by telephone on July 16, 2004, to prosecute the invention of Group I directed to the method claims 1-11.

The Examiner rejected claim 11 under 35 U.S.C. 112, second paragraph, as being indefinite. With the amendments set forth herein, claim 11 is in conformity with the requirements of 35 U.S.C. 112, second paragraph, and withdrawal of the rejection is requested.

The Examiner rejected claims 1-4 and 6 under 35 U.S.C. 102(b) as being anticipated by U.S. Patent No. 5,763,315 to Benedict et al. ("Benedict"). The Examiner also rejected claims 5 and 7-11 under 35 U.S.C. 103(a) as being unpatentable over Benedict in view of U.S. Patent No. 6,255,194 to Hong.

As set forth in claim 1, the present invention is directed to a method for forming a device isolation film that begins by sequentially forming a pad oxide film and a pad nitride film on a semiconductor substrate, selectively etching the pad nitride film to form a nitride film pattern, and etching the pad oxide film and a predetermined thickness of the semiconductor substrate using the nitride film pattern as a hard mask to form a trench. The method continues by

forming a thermal oxide film on the surface of the trench, and performing an annealing process under NH_3 atmosphere to form an oxide nitride film on the surface of the thermal oxide film. A liner nitride film is then formed on the entire surface including the surface of the oxide nitride film. Finally, the method includes forming an oxide film filling the trench on the entire surface, and performing a planarization process.

With specific reference to Figure 3f of the present application, the oxide nitride film 120 is formed between the thermal oxide film 116 and the liner nitride film 118 by an annealing process using NH_3 on the thermal oxide film 116. By performing the annealing process on the thermal oxide film 116 using NH_3 prior to the formation of the liner nitride film 118, the characteristic of the interface between the oxide film 116 and the liner nitride film 118 is improved, thereby decreasing the leakage current that occurs due to the liner nitride film without affecting the refresh characteristics of the device.

Benedict, by contrast, relates to shallow trench isolation (STI) with a single oxynitride liner or a dual oxynitride/nitride liner. In Figure 1F of Benedict, the trench isolation structure with a single oxynitride layer 20 is depicted. As shown therein, the single oxynitride layer 20 formed on the thermal oxide layer 18 according to Benedict is entirely different from the oxide nitride film 120, formed between the thermal oxide film 116 and the liner nitride film 118, according to the present invention. Significantly, the single oxynitride layer 20 structure of Benedict cannot achieve the effect of the present invention, namely the improved interface characteristic between the oxide film and the liner nitride film.

In Figure 2E of Benedict, the trench isolation structure of the dual oxynitride film 44/silicon nitride layer 42 is depicted. As shown therein, the silicon nitride layer 42 covers the thermal oxide liner 18, and the oxynitride film 44 is formed by oxidizing the silicon nitride layer 42. The resulting dual oxynitride/oxide liner formed on the thermal oxide liner 18 is entirely different from the structure of the present invention in which the oxide nitride film 120 is formed on the thermal oxide film 116 and then the liner nitride film 118 if formed on the oxide nitride film 120.

In addition, the method of forming the liner according to the present invention is not disclosed in Benedict. Particularly, the silicon nitride layer 42 of Benedict is formed on the thermal oxide layer 18 by the LPCVD method and thereafter the oxynitride film 44 is formed by oxidizing the silicon nitride layer 42. With the present invention, by contrast, the oxide nitride film 120 is formed by an annealing process using NH_3 on the thermal oxide film 116 and then the liner nitride film is formed by the LPCVD method.

For at least the foregoing reasons, claim 1 is not anticipated by Benedict and is patentable thereover. Favorable reconsideration and allowance thereof is requested.

Claims 2-11 are also in condition for allowance as claims properly dependent on an allowable base claim and for the subject matter contained therein.

Should the Examiner have any questions or comments, the Examiner is cordially invited to telephone the undersigned attorney so that the present application can receive an early Notice of Allowance.

Respectfully submitted,

JACOBSON HOLMAN PLLC

By Allen S. Melser by Sarp C Bailey
Allen S. Melser
Reg. No. 27,215 Reg No 40,495

400 Seventh Street, NW
Washington, D.C. 20004-2201
Telephone: (202) 638-6666
Date: October 28, 2004
ASM:SCB
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